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Greenwood

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(54) **SYSTEM AND TECHNIQUE FOR
CHARACTERIZING FLUIDS USING
ULTRASONIC DIFFRACTION GRATING
SPECTROSCOPY**

FOREIGN PATENT DOCUMENTS

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- (75) Inventor: **Margaret S. Greenwood**, Richland,
WA (US)
- (73) Assignee: **Battelle Memorial Institute**, Richland,
WA (US)
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May 6, 2002.

(51) **Int. Cl.**⁷ **G01N 29/02**

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73/861.25

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32 A, 54.41, 61.79, 64.53, 861.25

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Primary Examiner—Hezron Williams

Assistant Examiner—Jacques M. Saint-Surin

(74) *Attorney, Agent, or Firm*—Woodard, Emhardt,
Moriarty, McNett & Henry LLP

(57)

ABSTRACT

A system for determining a property of a fluid based on
ultrasonic diffraction grating spectroscopy includes a dif-
fraction grating on a solid in contact with the fluid. An
interrogation device delivers ultrasound through the solid
and a captures a reflection spectrum from the diffraction
grating. The reflection spectrum including a diffraction order
equal to zero exhibits a peak whose location is used to
determine speed of sound in the fluid. A separate measure-
ment of the acoustic impedance is combined with the
determined speed of sound to yield a measure of fluid
density. A system for determining acoustic impedance
includes an ultrasonic transducer on a first surface of a solid
member, and an opposed second surface of the member is in
contact with a fluid to be monitored. A longitudinal ultra-
sonic pulse is delivered through the solid member, and a
multiplicity of pulse echoes caused by reflections of the
ultrasonic pulse between the solid-fluid interface and the
transducer-solid interface are detected. The decay rate of the
detected echo amplitude as a function of echo number is
used to determine acoustic impedance.

26 Claims, 11 Drawing Sheets

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